



ANALYZING PLAYER EXPERIENCE OF MULTI-PLATFORM GAMES

A case study of a single player game

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Abstract

The player experience (PX) of games can be inspected in various ways to help developers understand the essential ingredients for a successful and engaging game design. Users are even able to experience games on a variety of different gaming platforms, which presents more ways of interaction compared to games that are restricted to only a single gaming platform. The overall chain of interactions between games and platforms, becomes a central design target to understand the complex nature of digital games. However, there are a limited number of studies that investigate how the gaming platforms affects the general PX, and how to conduct an effective evaluation on a game that exists on several platforms. The purpose of this thesis is to research the general PX of these multi-platform games and to generate information about a topic of interest where there is not much prior knowledge. This was done through a single case study using participants and measure their overall PX when played on two different platforms. This process used playability heuristics based on literature focusing on PX and usability, along with semi-structured interviews and observations. The data from this case study would then be discussed to serve as a base for a future hypothesis to be studied, and to discuss how research around multi-platform games can be managed and assist game developers in their process of creating an enjoyable PX. Besides presenting how games developed for several platforms can affect the evaluation of the PX, the study also presents findings for how players personal preference for gaming platforms can impact both their performance, and their opinions of a games design.

Keywords: Game development, multi-platform, cross-platform, user experience (UX), player experience (PX)

Contents

1	Introduction	1
2	Background	2
2.1	Related Work	3
2.2	Studies on Frameworks for Understanding PX and UX	4
2.3	Cross-Platforms Effect on UX	6
2.4	The Means-End Theory	6
3	Problem	7
3.1	Methods	7
3.2	Case Study	8
3.3	Research Structure	9
4	Execution of PX-study	10
4.1	Participants	10
4.2	Badland: A Side-Scrolling Action-Adventure Platformer	10
4.3	Approach	11
5	Results	13
5.1	Effectiveness	13
5.2	Learnability	15
5.3	Satisfaction	15
5.4	Motivation	16
5.5	Emotion	16
6	Analysis.....	17
6.1	Gameplay Controls	17
6.2	Preference of Platform	17
7	Conclusions.....	18
7.1	Summary	18
7.2	Discussion	18
7.3	Future Work.....	19
	References.....	20

1 Introduction

Gaming is a common international free time activity. It refers to playing electronic games using personal computers (PC), consoles, mobile phones etc. It can be executed individually, or with other individuals. It can be a source of relaxation or even distraction. The term gaming is a broad term that could refer to both casual and hardcore gaming, and games can come in different shapes depending on the demand of the audience. As an example, even though games were previously developed for PCs at the start, they can also be made available for other platforms. With the expansion of media, users have begun to interact with products and services on a growing diversity of platforms. In response services that is designed to work on several computing platforms are expanding, while their use is rapidly increasing (Majrashi & Hamilton, 2015). Notably, these are commonly called cross-platform or multi-platform services. For digital games the main difference between these services is how cross-platform allows players to interact with each other and the same session can be continued regardless of platform (Taylor et al., 2019). Multi-platform are games that can run on more than one device and can be used by different users using different hardware platforms (Albassam & Gooma, 2013). Multi-platform services are popular among the growing numbers of individuals who own multiple smart devices, like mobiles, small and lightweight laptop computers, and tablets. Regarding multi-platform services for video games, the digital distribution like social platforms and mobile app stores are increasing the digital download service for video games, which have changed the way of approaching the customers. It has allowed the designers to have further freedom and choose which platforms they wish to release their games on. Examples of some modern games that exists on several platforms are Hearthstone (2014), Genshin Impact (2020), Legends of Runeterra (2020) and Among Us (2019). A developer could even double their revenue from the same game by launching it on multiple platforms, while also gathering a larger user base (Bestebroer, 2017). These types of multi-platform games are all examples of new ways to entertain, educate and engage their audience, using different types of platforms.

Due to the importance of player engagement, there has been significant effort from researchers and practitioners in identifying and distilling the essential ingredients for successful and engaging game design. It has taken a prescriptive approach, like formulating the rules for game design and an analytic perspective, formulating the players experience (PX). Traditionally, PX assessment focuses more on the enjoyment of a game product, or the motivation of the players themselves (Birk & Mandryk, 2013, p. 685). There is no doubt that the players own enjoyment and motivation contributes to their engagement with a game, but do decisions regarding the play surrounding (the choice of device) affect players' experience on a greater depth? The purpose of this thesis will be a study on the general PX of multi-platform games and to provide developers with knowledge about the difficulties and the degree of balancing games in acknowledgment to multi-platform gameplay. It will do this through researching multi-platform games and explore how the type of platforms used during gameplay affects the player's game experience, in terms of enjoyment and motivation. It explains PX in an assessment using game platform types as the manipulation. To analyse the effects of different technical devices on the relationship between the player and a game, the study uses a layer of heuristic framework obtained from previous literature on usability and PX. Additionally, this thesis could be applicable to stakeholders in the gaming industry, student, and researchers around game development, who wants to gather an understanding of the needs and expectations of players in relation to platforms.

2 Background

The development cycle for a game begins its initial process in the concept phase, while later transferring over to the pre-production and production phase. The last phase of the cycle is the proceeding of a game's quality assurance (QA) (Nacke, Drachen, Göbel, 2010). For a game designer, it can come across as difficult to find balance in a situation where two or more individuals have a mutual dependence on each other during the game design process. A common approach for this matter is by using an iterative process, which is the action of testing and analysing a prototype, refine its design before then repeating the process. This is done to give the users the best experience and efficiently using testing to engage different elements. Video games has even changed the term we use when discussing and studying the experience of the users in the context of gaming. This is done by replacing usability with playability, and user experience (UX) with player experience (PX) (Aker et al., 2016). PX is preconceived as the individual, personal experience held by the player during and immediately after the playing of the game, and good player experience is the results from playing games to regulate moods or satisfying needs, motivating users to play certain games (Abeele et al., 2020). A digital game is not conceived for the user to deal with daily tasks, but rather it has a very specific objective: the game should give the player an engaging experience. This objective is more subjective and personal than traditional software.

To understand what makes experiences enjoyable to people, there has been many models towards describing and measuring PX in games during the past years. Some models highlight prominent concepts based on examination of core element of gaming experiences. One example of these concepts is the state of flow, which is described as the optimal state of enjoyment where the individual is completely absorbed in an activity (Csikszentmihalyi, 1990). Some examples like the model of the Nine UX dimensions (Ijsselsteijn et al., 2007) introduces nine dimensions based on these concepts (flow, immersion, competence, suspense, negative affect, control, and social presence), in order to understand the PX. Other models like the Game Engagement Questionnaire (Brockmyer et al., 2009) was designed to explore player engagement and measures the seven dimensions of competence, flow, negative and positive affect, challenge, tension, and immersion. All being aspects of video games that can induce optimal and immersive experiences. Other models measure these concepts by observing player behaviour, either directly by another individual or by analysing recorded material to provide a basis for a detailed analysis of usability (Pagulayan et al., 2003), as well as an entertaining game experience (Poels, Kort, Ijsselsteijn, 2007). Some models also measure these concepts by conducting an interview where the researcher follows a schedule of pre-prepared questions. An interview could even be flexible enough to allow the researchers to freely jump between questions if sticking tightly to a pre-prepared structure would annoy respondents (Adams & Cox, 2008). Interviews involve asking players questions, either during or after the gameplay, to understand their thoughts. Additionally, there is the option to use methods like subjective self-reports through questionnaires or surveys, which are paper based or delivered online to obtain data about recalled player experiences (Procci et al., 2012).

Despite these advanced models and frameworks, it seems like both researchers and developers does not share a common belief in their practical usage. Drachen et al. (2013) present an interview with the chief creative officer of Unity Technologies, Nicholas Francis. During the interview Nicholas was asked the question of how he thinks about the many

possible ways to study games, in this case how telemetry and analytics could be useful for the game industry. In his belief telemetry and analytics would be crucial to make more fun and better game experiences, and it is why the company's business model has made it the core proposition going forward. Here the interest is less on optimizing the revenue of the product, and more about assisting developers into making fun games. Nicholas however shared his experiences when testing out how developers try to balance out their game design, and as the tests recognized, most of the time the developers struggled when trying to minmax, micro-optimize and balance their games. Although they would acknowledge relevant tools as they were presented by Nicholas, their eyes would wander, looking for someone else to talk to. He would however say that this is a common behaviour, stating the following:

“I believe it is a human trait: when we don’t know exactly how to do something, we will do anything else, procrastinating the blurry task indefinitely.”

(Drachen et al., 2013, p. 137)

This illustrates that although analytics could be important to evaluate both game design and the PX, they are generally under prioritized as they are not part of the traditional perspective when wanting to optimize the revenue of a game product. They could however be useful to professionals with positions where the interest lies in the player behaviour, things like working with design, user research and quality assurance. Thanks to the adoption of user research methods, users have also become more integrated into the development process of games. Compared to how testing used to be about gathering friends and colleagues to find potential bugs and errors, it today relies on more sophisticated methods to provide the designers with direct feedback of the game's design. This introduction of user research in game development companies has been driven by the demand to gather a better understanding of the players themselves and has been highlighted due to the rapid publishing of social online games, and the games that follows the Free-to-Play business model (Drachen, El-Nasr, Canossa, 2013). Whether developers take a prescriptive approach, like formulating rules for a games design, or measuring PX through an analytic perspective, research on games seek to identify and refine the essential components for an engaging and successful game experience. While older concepts to describe and measure PX, like state of flow (Csikszentmihalyi, 1990), is still present in modern evaluation on PX, there is still researchers who continue to apply new theories of needs satisfaction to understand and explain player motivation and user experience within a game. This also carries through to the expansion of media and the growing diversity of platforms as various studies have investigated the effects of device diversity on attitudes and behaviours (Brynjolfsson et al., 2011). This growing diversity of devices has in turn increased the need for even better UX (Sweeney & Crestani, 2006).

2.1 Related Work

When investigating currently available approaches to evaluate PX, developers may find it difficult to find and select reliable tools to measure the overall engagement level of their product, and to identify specific areas of the PX that need improvement to better refine the design. They would most likely conclude that PX is an evasive concept to understand. This could be a consequence due to the many theories, models and concepts that have been proposed to define what compose a “good” PX. Currently, there is not one individual accepted or integrating construct to describe a person’s experience when playing a game, as

different theories come with different questions to ask players. Therefore this following section provides an overview of some existing approaches to evaluating PX, proposed frameworks for an effective evaluation and understanding of PX and UX, and previous work on how products affect UX.

2.2 Studies on Frameworks for Understanding PX and UX

As there is a need to conduct empirical research and collecting data from various gaming platforms, Aker et al. (2016) proposed their own playability heuristic framework to analyse multi-platform player experiences. They would use this framework to provide an in-depth analysis of two different gaming platforms, a mobile phone, and a video game console including a motion sensing camera. To develop this proposed framework, they used several existing methodologies obtained from previous literature on usability and UX. The framework of analysis would mainly be based on the playability model (PM) by Sánchez et al. (2009, 2012) and the 'Playability Heuristics for Mobile Games' model by Korhonen and Koivisto (2006). Here playability is referred to the analysis of video games and Sánchez et al. (2009) recognized playability as a set of properties that describe the PX by using a specific game system whose main objective is to provide enjoyment and entertainment. Although the PM by Sánchez et al. (2009, 2012) would be considered by authors as an easy-to-manage and well standardized set of heuristics to understand PX and its relationship with UX, Korhonen and Koivisto (2006) would indicate that former approaches on playability would not be practicable for the mobile platforms as mobile phones has unique characteristics, which require special attention during evaluation. Therefore their model would focus more on mobile technology, with an emphasis on the mobility module. This model of mobility was included due to how users usually have environmental distractions during mobile interactions. These distractions include lighting, weather conditions and noise. There can also be other individuals in the area, affecting the users gaming experience. Notably, although Korhonen and Koivisto (2006) would specify that heuristics for usability cannot be enforced to video games, they would base their model mainly on the user interface (UI). Aker et al. (2016) concluded that these different models needed to be user tested for multiple platforms for the purpose of validation. Therefore, their PM framework was influenced by the heuristics of usability (effectiveness, efficiency, and satisfaction). Respectively, the seven heuristics of effectiveness, learnability, satisfaction, immersion, motivation, emotion, and socialization, were proposed. The mobility model by Korhonen and Koivisto (2006) were also utilized. These heuristics would then be evaluated in terms of:

- **Effectiveness:** How easy the game was to play and how much effort it required.
- **Learnability:** The player's ability to absorb and master the game system and mechanics.
- **Satisfaction:** The gratification or pleasure received from playing the game.
- **Immersion:** The players awareness, absorption in the game, game realism, control agility, the social and cultural immediacy with the game.
- **Motivation:** The game characteristics encouraging the player to tackle and continue to perform actions until they were completed.
- **Emotion:** Players emotional impulses in response to the encouragement of the game, analyses through observation.
- **Socialization:** The set of attributes, elements and resources that endorsed the social dimensions of the game, experienced during a group scenario.

- **Mobility:** The game accommodation with the surroundings.

There would also be an introduction to a comprehensive approach of On-Screen and Off-Screen parameters. While the On-Screen represented the game element such as interface, mechanics, gameplay and storyline, Off-Screen represented aspects which only been partially explored in literature, which are social environmental aspects affecting the PX. Aker et al. (2016) state that these parameters were introduced due to the need of considering the social and environmental conditions for a better evaluation of PX. Other research would also indicate how social environments aspects (like the presence of other people), would make participants both play longer and increase performance (Kao, 2021). Akers et al. (2016) proposed framework was then tested on the same game on two different platforms through the procedure of three steps: a semi-structured pre-test interview, the task observation phase where behavioural data was collected through recording and mobile eye-tracking equipment, and lastly a post-test interview. The results of the experiment would show that players had a preference to play the game on the mobile platform, despite both platforms offering identical game mechanics. This was mainly due to encountered playability problems on the motion sensing camera, like struggling to reaching certain areas of the screen or negative effects on the players reaction time due to screen size. However, the novelty of the motion sensing camera would encourage players to experiment with other possible interaction methods, enhanced the experience of realism.

Another framework that would follow in the steps of identifying the key elements of cross-platforms UX were made by Wäljas et al. (2010). The focus of this research was on identifying how the characteristics of cross-platform services influence a user's interaction and experiences and was done with the purpose of contribution to the knowledge on cross-platform service UX. After a lengthy discussion about previous research on cross-platform or multi-device systems design and usability, in addition to studies on UX, three main characteristics of multi-platform UX were identified including:

- **Composition:** determines how platforms within a system or service, relate to each other and is one of the essential foregrounds in multi-platform design.
- **Continuity:** describes how the transition between platforms work.
- **Consistency:** one of the most highlighted principles in usability, especially with multi-platform systems and describes how consistency is leveraged through distinct system components

Wäljas et al. (2010) would then include the use of participants, using web-based services on PC and mobile phone while collecting their data through interviews and diaries. While the diaries were the main source of data collection, interviews were used to get a deeper understanding of the UX associated with interaction of these web-based services. Using this data, the three main characteristics were then broken down into a framework. Composition was confined into the component's role allocation, the distribution of functionality, and the functional modularity. The characteristics that determine how good a system supports were defined by continuity, focusing on the transition between task migration, synchronization, and transition between cross-platforms. The consistency heuristic is highlighted in relation to basic usability principles. Wäljas et al. (2010) explained that consistency might not be detailedly explained in UX. However, consistency would be an aspect that determine how fast users understand the usage, and how they recognize connections between the platforms.

2.3 Cross-Platforms Effect on UX

Following the cross-platform research, the next study focuses on analysing UX of cross-platform services by using a mixed methods approach, made by Shin (2016). The purpose of this study was to investigate in what ways cross-screen UX influence the adoption and usage of cross-platform services. By using a mixed method approach (focus groups, field study, survey, neural network, and experiment) and identifying human heuristics in multi-screen adoption, the research would reveal that the key element of cross-platform UX includes the aspects of access, mobility, and coherence. Shin (2016) would then state that heuristics is a way to disclose how the UX of cross-platform services are formed, moderated, improved, and how users' intentions are determined, and to understand UX, mixed methods are required.

2.4 The Means-End Theory

Last part of this chapter is less about how multi-platform affects the UX, but more on how products themselves works as a mean for consumers to achieve certain benefits or desires. In the early stages of marketing research, there was a recognition to how the attributes of products is not the reason for why consumers purchase a product, but because of the benefits they would bring. This hypothesis is called the Means-End (ME) theory (Gutman, 1982; Reynolds & Gutman, 1988). The attributes of a product would be referred to as “the means”, while the benefits or desired to own the product would be the “consequences”. The reason why a consumer would desire a product is less about the attributes they would bring, but instead lines up with their personal values, the “ends”. This means that the preferences a consumer would have for a product, how they view the attributes of a product, will most likely produce the desire of their benefits. This would then validate the products to meet the consumers values. Theoretical models like the Player Experience Inventory (PXI) also draws on the ME theory to provide a tool for researchers to measure PX and investigate how game design choices are linked to emotional responses (Korhonen & Koivisto, 2006). If we break down the ME into the most basic shape, like a chain, consisting of the products attributes, the functional and emotional benefits that cause a desire for the consumer. Additionally, this would align with their individual person value (see figure 1).

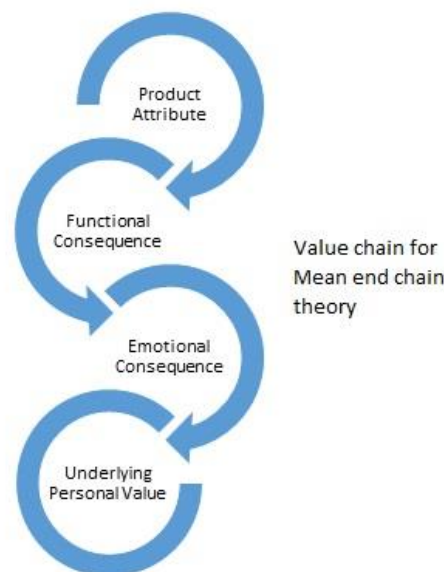


Figure 1 A Means-End Chain Consisting of Attributes which Align with Personal Value

3 Problem

What is prevalent despite the previous executed research on applied methodological approaches on measuring PX is that altogether they attempted to either qualify or quantify the experience of the player. There has been some previous research that focuses on the analysis of multi-platform player experience based on PX, like proposing new heuristics frameworks (Aker et al., 2016) or contribute to the knowledge about the experiential side of multi-platform configurations (Wäljas et al., 2010). These platforms offer different capabilities such as different screen resolution, screen size or the possibility to feature novel controls such as interactable touchscreens. Therefore, the gaming platform should be considered to an important role in terms of the experience. However, as Aker et al. (2016) states, due to the limited number of studies on multi-platform games, and how the standard UX and usability methods are mostly focus on the efficiency of digital platforms, these tools are not sufficient for the entertainment aspects which upholds the PX. The PX of multi-platform games is a complex subject and is challenging to understand when there is not much prior knowledge. It is difficult to both figure out how the PX of multi-platform games should be evaluated, and what kind of results we could expect to find during the process. Therefore, this thesis has a practical view on PX and focus on just the PX testing of the same game but for different platforms. This is done with the purpose of gathering knowledge about the topic of multi-platform PX where there is not much prior knowledge or research. The findings of the thesis will then be used to determine how the different gaming platforms could influence the outcome of similar studies. If the area of research and the game industry itself are more knowledgeable about how platforms could influence their analysis, that could potentially lead to more efficient PX evaluations and development of games that exists on several platforms. Additionally, the study will discuss how research around multi-platform gameplay can be managed and assist game developers in their process of creating an engaging experience for their players. Comparing the PX between different gaming platforms was an essential choice for this research due to how a) the platform act as the link through which players engage with the game, b) there is an increasing number of games released on multiple platforms, and c) there is still a need to conduct experimental research and collecting data from various gaming platforms. For this evaluation the platforms will be narrowed down to just two, the PC and the mobile phone. The first device being selected due to how mobile context has some unique characteristics, and both platforms being associated with fundamentally different interaction criterions or input controls.

Research Question: *How does the platform influence the outcome of player experience studies on multi-platform games?*

3.1 Methods

Before going any further, an overview of the layout and structure of how the research purpose and problem could be provided. There are various ways to approach this topic, but the one chosen for this thesis would be to assemble the research into two separate parts. The first would be to conduct a study on a multi-platform game and independently analyse the PX from both the platforms. The second step would be using a research method to then compare how both experiences differs or complements each other from a multi-platform perspective. Below is an explanation of the research method, followed by how the research will be laid out.

3.2 Case Study

Continuing the process of finding an appropriate methodology as a basis to answer the research topic, the following practice examined would be the case study method. A case study is explained as a research methodology, usually seen within science for communal and life disciplines. Gustafsson (2017) mentions that although there is no general definition of a case study research, it could commonly be defined as an intensive study about one individual, group, or event. Additionally, he proclaims that it is aimed to generalize over several different units. You could also describe a case study as a systematic investigation of single individuals, groups, communities etc. where the researchers extensively analyse data related to different types of variables (Woods & Calanzaro, 1980). The term case studies by researchers are described to examine complex events in a natural environment, aiming to expand the comprehension about an exciting or noteworthy event that one experiences first hand (Yin, 2003). The appropriate procedures according to Stake (2006) when using the case study methodology are the same when compared to other types of research. The first point of entry is to define a single instance, or a batch of similar instances which can be assimilated into a multiple case study. This serves to establish a fundamental understanding of the instance, and it is this basic understanding of a research topic that then develops into a research question. The case study data is generally qualitative but does not restrict other forms of data entirely. Proceeding to the general benefits of using the case study methodology, notably there are differences when accounting for single and multiple case research. A single case study is called for when a researcher wants to study specific events and involves collecting several types of data for a comprehensive understanding. Meanwhile a multiple case research study allows the same kind of understanding, but for the cases as a unit. Evidently, a multiple case study is commonly more reliable as it allows for more in-depth exploration of research questions and theory development (Stake, 2006). Despite the above-mentioned benefits with using the case study methodology it does not come without its own limitations. Mainly the difficulty to organize the sheer amount of data from a case study is a topic of consideration, meaning a researcher needs to carefully think through their analysis and integration strategies.

The topic of multi-platform gameplay is a complex one, and there is a limited number of studies regarding the novel interaction possibilities that it provides. As the objective of this thesis is simply designed to aid the researcher in understanding more about a particular topic of interest where there is not much prior knowledge. This recently discovered knowledge could then be used to assist developers in their future work. The study topic is relatively broad and there is no formal hypothesis to be tested. Therefor the above-mentioned case study method could be combined with use of an exploratory study. In exploratory studies, broad questions are asked to generate information in areas where there is moderate amount of previous knowledge (Hallingberg et al., 2016). The aim of exploratory studies is to generate information that can form the basis for confirmatory hypothesis testing in future studies. Additionally, it could help to connect ideas to understand the groundwork of the analysis without adding any preconceived notions or assumptions yet. By combining a case study and an exploratory study for this thesis, it will serve as the base for when we analyse how the experiences differ or complements each other from a multi-platform perspective. However, there are many methods and research proceedings one could use to analyse a topic. This suggested approach is simply presenting one of many solutions for the research purpose and problem, not suggesting that this is the better course of action.

3.3 Research Structure

To compare how the PX differs or complements each other from a multi-platform perspective, or even to evaluate PX, the study needs a source of data on the experience that an individual might have while playing the same game using two different platforms. These results could then be used to evaluate the PX and examine how each platform experience differs or complements each other from a multi-platform perspective. In other studies that evaluated the experience of users or players (Aker et al., 2016; Wäljas et al., 2010) web-based cross-platform services and a multi-platform game were used to gather this data. Similarly, this study will do the same by examining the PX of one of these multi-platform games. The game picked for this study was selected in reference to being established on many platforms and characterized by a high degree of development, free from bugs or other playability issues. Hence preventing the results of the PX being affected by unfinished game mechanics or functions. Notably, the desire of this thesis is to keep the execution as simple as possible. This is due to how the objective of this thesis is simply designed to gather knowledge about how platforms influence multi-platform studies on games, and there is no formal hypothesis to be tested. Therefore only the single-player part of the game will be used for testing. This can be a crucial limitation of the study, as it only allows evaluation of certain parts of the game. But to keep the research from becoming too extensive this is a preferred approach, especially since it involves two separate versions of the game that needs to be tested.

To carry through the PX study, a prominent concept or model could be used to provide an in-depth analysis of two different gaming platforms. Hence, a set of attributes and properties to identify and measure the experience of players should be established. Here the functionalities of playability heuristics is used. The concept of these heuristics is to function as a tool for studying the playability across different video game elements, like a player's enjoyment or motivation. For measuring these kinds of categories, researchers usually must create their own models (Aker et al., 2016), or rely on a combination of several scaled or methods. In this study, the framework of analysis is based the heuristics of effectiveness, learnability, satisfaction, motivation, and emotion. In the PM framework (Aker et al., 2016) there would be other dimensions including socialization and mobility. However, with a focus on just the single player, any constructs that involved socialization would be left out. The same would apply on narrative constructs as it would not apply to certain game genres. However, using a combination of different heuristics might results in extended interviews, intersecting constructs, and items, or even exhaust the participants. This could ultimately be troublesome when compared to the rapid cycles of testing found in the game industry (Abeele et al., 2020). To gathered data from the different platforms, participants would also need to be recruited. Ensuring they would have the right to receive information and ask questions about the research, an informal consent would also need to be given. Participant would have to play the game on every platform for the data to be conclusive. Consider how only the single player segment would be featured in this study, it would be possible to play on every game platform during the same session. This process would decrease the number of individual sessions. This approach would be a rather simpleminded way to test games for multiple platforms, since other studies (Aker et al., 2016; Wäljas et al., 2010) would conduct the testing of platforms independently from each other. For single player experience this is possible, but it is a waste of resource data. Compilation of PX can potentially make an efficient process, but there is a lack of knowledge about how the process should be done. Once the data could be gathered from the participants, an evaluation of PX between platforms can be analysed and discussed.

4 Execution of PX-study

This chapter serve as a more detailed explanation of the execution of the PX study, including the use of a mixed method approach, the gathering of participants, description of the multi-platform game used for the study, and the procedure of how it was conducted. Firstly, to conduct this empirical research and to collect data on multi-platform PX, the study uses the concept of playability heuristics. These are used to provide an in-depth analysis between two different gaming platforms. These can be gathered in a variety of ways, but several researchers (Park et al., 2013; Shin et al., 2013) suggests that using just one method is not enough. Regarding the examination of UX for multi-platform services as an example, conventional UX studies are concerned with interactions between the user and a device. Interaction between numerous platforms offers both different experiences and could reveal different user behaviours. Therefore, it is suggested that to confront the complexity of the UX, there is a need for a mixed method approach. Accordingly, this PX-study will use the mixed method approach of playability heuristics using semi structured interviews and observations. The use of a mixed method approach would paint an accurate picture of what is happening to the player inside the game. The organized skillset of the researcher is another important factor for the experiment. Instead of constantly allowing the enthusiasm for learning new technologies or methods impacting the researchers own expertise, potentially making the analysis suffer, previously familiar methods were preferred. Consider the short timeline for the study, a comfortable solution with recognizable tools was favoured. Commonly, if the same methods or technologies always have a continued use depending on the researchers own comfort, the expertise in in new emerging technologies could suffer.

4.1 Participants

In summary, there would be no specific number of participants required to conduct the study. The exact number can be discussed and can generally vary depending on the desired amount of data. A total of 16 participants were recruited through an online form which was distributed through a game development education community on the social media platform discord. The data set consisted of 11 male and 5 female participants. Participants were between the ages of 18 and 39 and were all currently settled in Sweden. Accordingly, all participants had a short introduction to the key elements of the research, what their participation would involve and were informed that they could cancel their involvement during any of the experimental phases. They were then given an individual time and date of when the experiment would occur. If one participant would not be able to attend the specified occasion, they would be provided with a new opportunity to attend. All testers were compensated with free drinks and snacks, with the possibility to receive the game for free (individual player with best performance) when participating in the experiment. The game itself is listed in detail below.

4.2 Badland: A Side-Scrolling Action-Adventure Platformer

The game that was used to examine the PX between the two gaming platforms was the award winning 2D action-adventure Badland (Frogmind, 2013). Badland (stylized BADLAND) is a video game originally designed and released on the iOS and Android platforms in 2013, specifically targeting the mobile phone users and later released on Windows Phone 8 in 2014. There is also a Game of the Year Edition that was released in May 2015 for PlayStation

3, PlayStation 4, PlayStation Vita, Xbox One, Wii U, Steam for Linux, Microsoft Windows, and OS X. Recently it had a release in August 2021 for the Nintendo Switch. There is a total of 100 single-player story, 100 co-op and 27 multiplayer levels. Only the single-player story levels would be used for the playtests. It also supports both cross-buy and cross-save functionality. The main objective of the game is to fly a small bird-like creature through a forest, like Flappy Bird (Nguyen, 2013). Player solves traps, puzzles, and obstacles (see Figure 2 for a screenshot of the game). The fundamental cause for picking this specific game for the study was how it focuses on gameplay compared to other components like narrative. This focal point on gameplay was expected to facilitate comparative data collection and the analysis of generated data. The in-game controls were also very simple, using the arrow keyboard buttons for PC and utilizes simple tapping on the mobile touchscreen to lift the character upwards and become airborne for a short period of time. Since the game versions for each platform had equivalent gameplay and mechanics, it would enable the moderator to also observe and focus on the similarities or differences in PX between each gaming platform. While the game offered the players to change the controls in the setup menu according to their preferences, during the experiment subjects were only allowed to use the predefined controllers.



Figure 2 Gameplay from the 2D Action-Adventure Game BADLAND (Frogmind, 2013)

4.3 Approach

The performed PX study for this research were divided into two sections. The first half would be dedicated to gameplay, while the latter half is a one-on-one interview. Each 16 playtest session lengths were about 1 hour on average, with 45 minutes playtime and 15 minutes for interviews. Participants also had the option to play longer, if preferred. A major challenge during research was to find an affordable, effective, and simple setup for the testers to use. Fortunately, through contacting one of the moderators of the same game development education community on Discord, there was a soundproof room (insulate room where less noise can be heard outside) available (see figure 3). This way each participant, whether they

would be students or interested residents were able to effectively locate the test site. The office owners were also able to provide the moderator with a space outside the room with a room divider where they could observe the gameplay interaction in privacy. Additionally, a gameplay ready PC, an adjustable HD webcam, headphones, stopwatch, and office supplies (papers, sticky notes, pencils, keyboard, mouse, monitors, headphones etc.) were offered without incurring any additional cost. The only components that had to be brought or purchased from the moderator's own resources would be a gameplay ready mobile phone (Apple iPhone 8 Plus), snacks and a full version of the game used for of the two platforms. Once participants arrived, they would be given an open-ended task, to simply play the game on every platform as they would on their own. Beforehand, they would also be asked their preferred platform. Once the moderator would leave the room after the task been given, the participants would start their session. It should be noted that initially all participants could make their own personal choice of which platform they would begin using. This was done with the thought of making the players feel more comfortable with the structure of the test. However, as the study would continue, of the first 10 players only 2 would pick the mobile phone as the starting platform, making the distribution between starting platform vastly uneven. To handle this complication, the remaining participants were asked to begin their session with the mobile phone version of the game (see figure 5). The following observations would then be done through webcam and audio, while their gameplay is recorded in combination with moderators taking real time notes. After 45 minutes, the session was aborted if players had not finished the level (unless requesting for additional gameplay time). To understand and analyse the player experience in detail, the last phase consisted of an interview with pre-prepared questions which each participant was asked to answer and recall their experience in detail. The studies finding was expected to provide a deeper understanding of the general PX of the game on two different platforms.

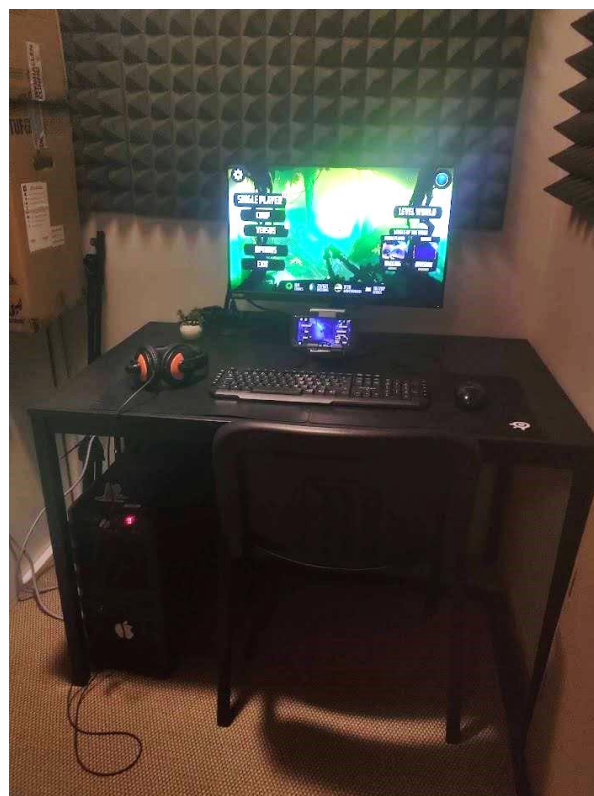


Figure 3 PC and Mobile Setup

5 Results

In the following sections, a report of the outcome on both gaming platforms is briefly explained, followed by main feedback received.

5.1 Effectiveness

The effectiveness of the platforms was estimated in terms of how easy the game was to play, along with how much effort it required. In terms of player performance, the PC platform had a higher performance overall. Below presents a comparison of the two platforms in terms of the average completion of levels for each player (see figure 4).

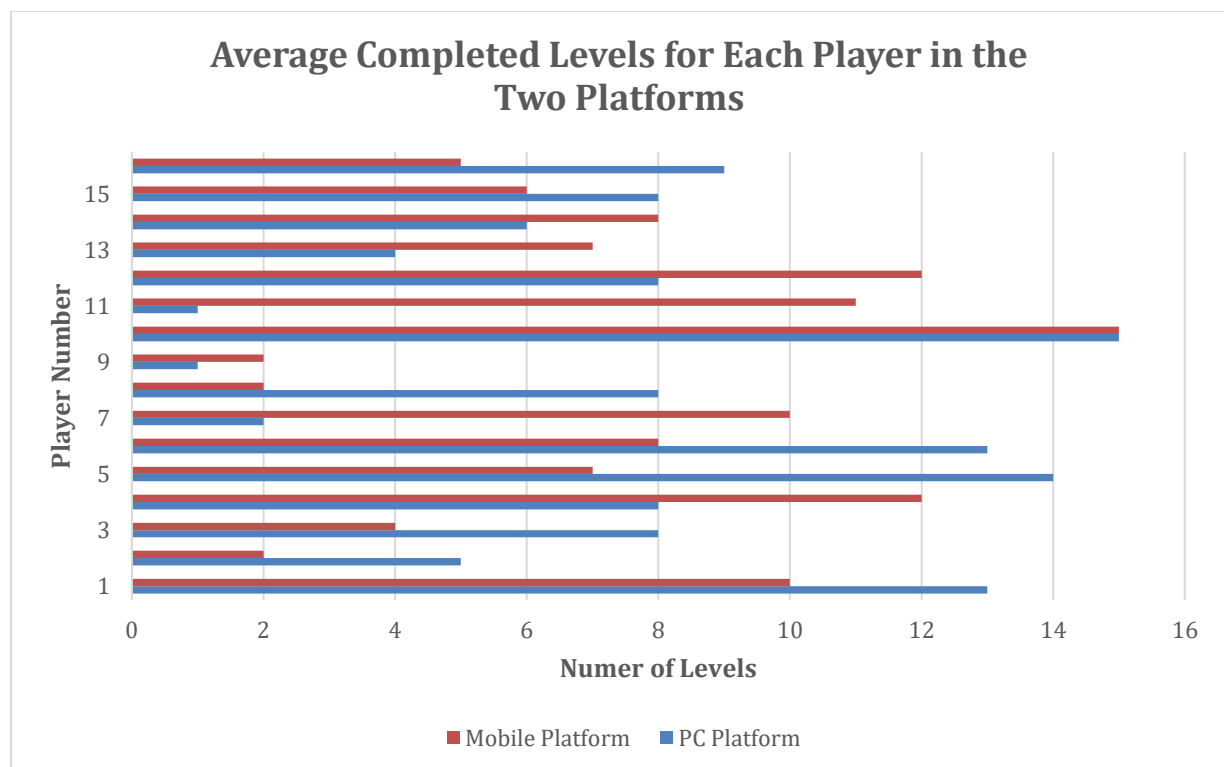


Figure 4 Average Completion of Levels for Each Player in the Two Platforms

The game would be described by all players to be easy to interact with, although most players would indicate that the PC version was the easier platform to get a higher performance with. This was mainly due to how the PC platform were described by players to allow for more control, like moving in both a horizontal and vertical directions or control the acceleration of the speed, making it easier to manoeuvre when the gameplay required for more precise controller inputs. Meanwhile on the mobile touch screen, the controllers of the game would only allow for vertical movements, making players feel like the mechanics required a lot more effort to do what they wanted.

“Most frustrating was touch controls, it kept moving to different spots and sometimes the touch controllers were unreliable. I always had to kept track of my fingers position”

(Player 1)

When asked about the touch controller’s players would state “I felt exhausted” (P1, P5, P8 and P9) due to the very intense tapping of the screen. There would be a lack of energy to perform, as the inputs would feel fast and happen to frequently to stabilise the pace of the gameplay. Some participants would however praise the mobile version due to the screen size (P4, P8 and P11). It would allow them to notice obstacles faster, giving more focus the objectives and less tired eyes after gameplay. Many players would however claim that they expected their performance to always be higher on PC, because this was their preferred platform to use while gaming (see figure 5).

“I expected a much high performance on PC due to me playing a lot of games on that platform. Additionally, I performed well on phone, so I need to do better on PC. I guess that is a natural feeling”

(Player 4)

This preference would additionally be correspondent with the choice of starting platform (see table 1). If a participant had the option to choose which platform they wished to play on first, it would generally be the one that aligned with their personal preference. This would however not mean that players would always perform better during the initially gameplay, some achieving higher performance when switching device (P7, P15 and P16). The option to choose starting platform would eventually lead into an uneven distribution between which platform participants chose to play on first. Hence the option to pick starting platform was removed for the last 6 players. The overall level completion times being less on the PC indicates that this platform gives players a higher means to succeed with their goals. In the case of this study, it would be the amount of completed levels during each individual session time.

Player Number	Starting Platform
1	PC
2	PC
3	PC
4	Mobile
5	PC
6	PC
7	PC
8	PC
9	Mobile
10	PC
11	Mobile
12	Mobile

13	Mobile
14	Mobile
15	Mobile
16	Mobile

Table 1 Table of Starting Platform for Each Player

5.2 Learnability

This section refers to players ability to understand and master the game system and mechanics. All participants were able to understand the game core mechanics without much effort. The lack of a tutorial or gameplay instructions would however extend the learning process of some players, notably they would navigate around in the menu to find instructions for how to play (P8, P9 and P14). While there was no major difficulty of learning the games mechanics on any platform, the most notable difference was the number of buttons required to control the game character. While the mobile phone only used the simple mechanic of pressing the touch screen, the PC version used the arrow buttons to navigate. This change in interaction made it very difficult for some players to grasp the core mechanics, especially for those who started playing on the mobile phone. The most notably example is how one player got stuck in one level while playing on PC. One segment required the player to move horizontally to pass the upcoming obstacle. But due to how the player has adapted to the mobile phone format of gameplay in such a profound way, they were unaware that moving in a horizontal direction was possible. This eventually left them stuck on the same segment for the remaining time of the session.

“In term of the controllers, on mobile you could only move up and down, but on PC you could move horizontally. I was not prepared for that sudden change and got stuck”

(Player 11)

Other participants would also state that they believed that the mobile platform would allow for an easier experience to understand the core mechanics (P4, P9, P10 and P15). This simple introduction would then have allowed for players to use the PC version to master the game, receiving an even higher performance.

“Had I been more into the competitive bit of this ordeal, I would have started on my phone to know what the game is and then tried to use my comfort on PC to steamroll the levels”

(Player 10)

5.3 Satisfaction

In terms of satisfaction received from playing the game, most players would refer to the game as an entertaining experience. Although some referred to the experience as stressful and too challenging, all of them would consider playing the game again using any of the platforms. The players who preferred the PC platform considered this platform to be more fun due to

the increase of control, and it being their platform of preference. Since both versions offered the same aesthetic experience, this aspect was not comparable between the two platforms.

5.4 Motivation

Despite the satisfaction from playing, the motivation to play varied between participants. While the majority initially felt excitement to play an unfamiliar game, some players (P2, P8, P9) decided to end their session after the difficulty of the gameplay became too intense. Others had the motivation of performing, achieving the highest score possible. But due to the lack of control on the mobile phone making it feel less unresponsive, there was a loss of player motivation to play competitively. Instead, the mobile phone was seen as a more casual experience, becoming an experience where players would feel less pressured to perform. Although with the trade of achieving a lower performance. However, a few players (P4, P7 and P9) noted that they were excited to test the game while using the mobile phone, due to the unfamiliar experience of using a phone for gaming purposes. Similarly, players (P1, P10, P14 and P16) would indicate that they were not motivated to play the game using the mobile phone, because previous mobile games had been a tedious and repetitive experience.

5.5 Emotion

The emotion of the platform refers to the players impulses in response to the stimulation of the game, which is analysed through observation. The emotional responses during gameplay varied more between players, rather than the opposed platform. When a player reacted with excitement, like yelling, this was usually during gameplay that required high focus and allowed small rooms for gameplay errors. If a player would fail during one of these instances in a rapid succession, they could remove themselves from the game momentarily, or look into the observing camera with a negative expression. This same reaction was observed regardless of the platform in use.

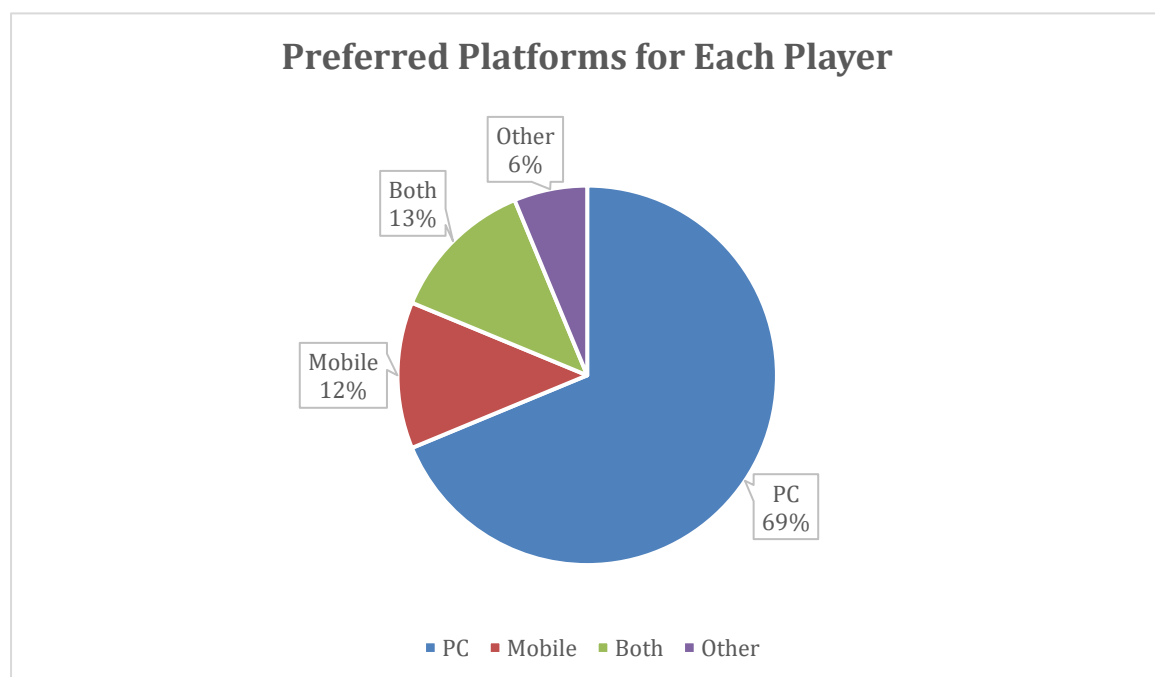


Figure 5 Chart of the Preferred Platform for Each Player

6 Analysis

In this chapter, the PX of the game will be established, including how the two different platforms influenced the study. During gameplay, players showed a high interest and enjoyability between the two different platforms. While the game lacked information on how to play the game, all players were able to learn the core mechanics and gradually complete more difficult instances. Most players would see themselves play the game again with the desire to explore more game levels, or simply aim for a higher performance. However, there are some key aspects of both the game, and the participants which gradually influenced the study in unexpected ways.

6.1 Gameplay Controls

The first aspects are how the games controllers are managed. While we could expect the core mechanics to perform similarly on both platforms, the data from the PX-study shows that this is not the case. While the gameplay looks similar on the surface, the different controls of the platforms influenced not only how participants would play the game, but also how they would feel about it while playing. In reference to the mobile phone, the only way of interaction and control is by pressing the touchscreen in a rapid succession. Although this is a rather simple task, it also drained the participants of energy, and restricted the movements of the character. Meanwhile for the PC, the use of the keyboard allowed for more precise and unrestrained movability. This allowed player to move both horizontally and vertically. Subsequently, this made the controls on the PC platform appear like the better version of the game if participants wanted to achieve a higher performance, which appears to also be the case (see figure 4). This aspect of less interactable controllers of the game can be considered as a direct connection to the game completion performance. Especially since BADLAND is a game which is mostly focused on dynamics and mechanics. However, there is also the indication that players would already have a somewhat predisposed apprehension of what the gameplay would be like, and how they would perform between the two platform. This can be associated with their preference of platform.

6.2 Preference of Platform

In reference to the players individual performance, players referred to how they would expect a higher rate of achievement, or pressure from playing on the PC platform. When asked about the subject, they would state that this was due to their previous experience and preference of gaming platform. In connection to their preference, there was a feeling of self-demand of accomplishment, especially due to how the mobile phone was an unfamiliar experience. Additionally, although some players would feel excited to use a mobile phone for gameplay, there was also players who mainly desired to use a PC. If we would analyse the preference of platforms between each individual participant, a total of 69% (see figure 5) would have a strong preference to play games on PC. This enthusiasm for one specific gaming device, regardless of what the other platform might offer, would create an already predetermined view of how the player would perform, but also how much they would enjoy their experience. This desire for products that are used to achieve certain benefits or desires in players, like a high player performance or PX, could be linked back to the Means-End theory (Gutman, 1982; Reynolds & Gutman, 1988) on how consumers desire a product or an object, because they align with personal values, not because of their attributes.

7 Conclusions

7.1 Summary

This study analysed multi-platform PX. Based on the results, it can be concluded that the players were satisfied that they experienced playing the game on both platforms. However, some lost interest in the game due to the playability problems they encountered. At the end of the tests, most players stated that they preferred to play the game on PC rather than on mobile phone. Some guidelines that this study would give developers on how to plan their development and testing is the need for controllers to feel interactable and enough responsive for the player to perform the action they want on all platforms. Otherwise, one version may feel more biased against achieving better results, while the other can only be a casual experience. Most players also have a platform they enjoy gaming on, and this could impact both the performance and their enjoyment of the game design. Preferably combine testers that has an equal preference for platforms, to get a neutral result. Research on PX can help developers to identify these specific gameplay problems as they present a set of rules that aim to support the development of games. Which to use for multi-platform games are however difficult to disclose. Next to more general heuristics, which cover different aspects of a game, usability heuristics with a special focus on technical or learning aspects of games are also available. However, the development of heuristics for games is still ongoing and more research is needed to create a coherent set of frameworks. These concepts would then have to be used to evaluate all kinds of digital games, and in all kinds of different settings and environments, in a home residence or on mobile devices. When evaluating if players interact with a game as intended, or if undesirable or sudden behaviours appears, the results gathered by researchers are directly useful. Most importantly, the translation of player behaviours from data to characterization that base themselves on game design and similar terminology, is crucial if the information is going to be useful and understandable by the developers in the gaming industry.

7.2 Discussion

While referring to the heuristics used during this study, there is the need for these constructs to be tested and validated through real evaluation experiments and settings, if they want to be useful for the gaming industry. Although these constructs might be correctly specified, it does not mean it always apply to digital games in the same way. Especially if considered how the researchers in the field of game design tend to use terms like flow, immersion, competence, suspense etc. to describe the same PX, despite doing their own exclusive implementations. Additionally, it is not clear how the testing of different gaming platforms should be combined. Undeniably the gaming industry already have answered these questions by creating their own established constructs to evaluate all their products. The importance of a good PX has been identified for a long time, so there must be something in the gaming industry which allows developers to understand how to give the player an engaging experience. This might however be something that the researchers in the field of game design still have little knowledge about. For future studies that wish to take up the challenge of developing an understanding about PX and gaming platforms, one essential suggestion would be that interviewing companies that develop multi-platform games could become a valuable resource. This kind of knowledge would likely improve researchers' ability to further guide game developers on how to create the optimal PX and advance the theory as a

whole. A major finding during the experiment is how players personal preference for gaming platforms impacts their opinions of a games design. Because most of the players had PC as their platform of preference, the use of touch screen controllers made the gameplay feel too fast and there was a lack on control of the character. Meanwhile the PC version offered more buttons to interact with, allowing the players to move in both horizontal and vertical directions. This slower and more control of gameplay would make them enjoy the scenery more and feel less stressed while playing. The increase in buttons would however increase the time of learning for some players, compared to the single touch on the mobile screen. For developers, the subject of how they adapt the controllers to the platform is an essential component for the PX. There is a need to consider how each platform allow their players to control and interact in a way that feels accessible and unbiased. One platform should not feel less interactable because of the size or hardware. The controls especially should fit all players, regardless of their preference for other platforms. Additional findings are how players would feel pressured to achieve a high performance. This was especially apparent when players expected their individual performance to greatly match their experience or preference for the gaming platform. If a player preferred the PC platform over the mobile phone, they would feel a need to perform better on that platform compared to the other, despite if they performed exceptionally well using both gaming platforms. No matter how well they would perform using one device, they would always lean into the idea that playing on their platform of preference need to conclude in a greater achievement. Perhaps this is a mutual belief, that we should always be able to accomplish greater things when inserted in situation that favours our previous knowledge and experiences. Compared to the opposite (like playing on an unfamiliar platform) would make the aspiration for good results feel less important, and players are simply there to learn at their own pace.

7.3 Future Work

To discuss the topic of future work, it can begin with how the game data from this research were extracted using heuristics based on usability and PX. It does however not provide data free from bias inducted by using a laboratory setup, like avoiding modifying their natural gaming habitat of the participant. Perhaps allowing participants to play in their own home environment would allow for a less diagonal results. Future research is also needed to expand on the sample group. As this study used a very specific group of participants, all having some knowledge about game design and mainly a preference for the PC platform, this does not reflect the general population. More than likely the results from the preference of platforms would change if the study was conducted in other locations were the general population favours gaming on mobile phones. Another point of interest is while this study focused mainly on multi-platform games, a future work could expand further to include the PX of cross-platform games. Since cross-platform games allows players to interact with each other and the same session can be continued regardless of platform, this would allow the researcher to evaluate further on how platforms can affect the PX, be it socialization, competitive or cooperate aspects etc. All these aspects can be considered important if we wish to understand the full potential of what different platforms may offer their players. The option to include an individual reward for best player performance also needs to be addressed, as it makes the gameplay competitive rather than a casual experience. In a future study this compensation would instead be removed. The use of interviews with industry experts would also be essential, not only to clarify how these companies test their games on different platforms, but also what constructs and tools they use for their evaluation.

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